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WOMEN AND THE AUSTRALIAN ICT INDUSTRY: AN ANALYSIS OF ABS CENSUS AND SURVEY DATA

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Abstract

This paper presents an in-depth analysis of 2006 census and survey data collected by the Australian Bureau of Statistics (ABS) pertaining to the Australian ICT industry. Of particular interest were the participation rates of women and the issues of pay equity and women's representation at senior management and professional levels. Where possible the 2006 census data are compared with earlier census data while the labour force survey data provide time series data from 1996 through to 2010. The labour force survey data give a more up to date picture but have the disadvantage of being subject to sampling error. Women's participation rates in ICT managerial and professional roles have changed little since 1996 and the gender pay gap in the ICT industry varies between 10% and 20% across major ICT professional occupations.

Keywords: Empirical research, secondary data analysis, exploratory study, social issues.

1"INTRODUCTION

The income disparity or “gender pay gap” as it has become known, has received considerable attention in recent times (KPMG 2009; Olsen & Walby 2004), where the issue was examined across the entire workforce. It has also received recent media attention in Australia (Fox 2010) and it was a major priority and ongoing concern for the Australian Council of Trade Unions (ACTU) in 2010. In Australia women working full time earn around 18% less than men, which means that over their working life they can be around \$1 million dollars worse off. Women graduates earn around \$2000 less than male graduates and this gap increases over time (Equal Pay and Better Jobs for Women 2010). A recent report from the National Centre for Social Economic Modelling (NATSEM) found that simply being a woman accounts for 60% of the wage gap, that is, after taking account of the effect of many other factors such as education, experience, type of occupation etc. Most of the gap can only be explained by gender (i.e. discrimination¹). This paper explores the most recent available data pertaining to employment growth, participation of women and income disparities between men and women within selected ICT occupations. The aim is to provide an up-to-date view of these issues in an Australian context. Information sources include quarterly labour force and income survey data which provide a longitudinal perspective on major variables of interest and, Australian census data which provide accurate quinquennial snapshots at a more comprehensive and detailed level. These data sources have been analysed and transformed to reveal time trends and where possible, compared to provide a richer analysis in support of our conclusions.

The participation and remuneration rates of women in the ICT industry have important economic and social implications for Australia. Increased participation rates of women are needed not only for social justice reasons i.e. a fair share of highly paid occupations, but to provide diversity of ideas in the development of ICT products and services so that they better meet the needs of all users. Previous research has identified a gender wage gap in the Australian ICT industry (e.g. Byrne & Staehr, 2005) and it has been estimated that its removal would result in a growth in GDP of several billion dollars (Cassells et al. 2009; ICT Industry Policy Factsheet 2009). In this paper evidence is provided that the ICT industry is still no exception in this regard and in some areas exhibits a gender pay gap well above other professions.

2"BACKGROUND

Women have worked in the IT industry since its early beginnings in the 1950s when computers started to be used by business to perform administrative tasks. The work was structured such that at first sight it seemed that a likely career path would involve promotion from clerk to key-punch operator to machine supervisor. Since most of the women were key-punch operators and promotion occurred mainly within these three job classifications (Haigh 2010), opportunities for women to have a career path were restricted. However, a new job arose, programming. Due to a programmer shortage women were encouraged into the field. Some estimates put the percentage of female programmers in the 1960s at around 30% (Ensmenger 2010). These women had access to a professional technical job, whilst most other women at the time were in clerical and service areas of employment (Donato, 1990). Although women were entering this male domain, it did not mean they were equals. There was, and even today there is, a tendency for women to be in lower paid and lower status occupations than men within the IT industry (von Hellens & Nielsen, 2001; Woodfield, 2002; Byrne & Staehr, 2005).

There are a number of Commonwealth, state and territory government laws in Australia that make discrimination on the basis of gender unlawful e.g. Sex Discrimination Act 1984 (Cth), Equal Opportunity Act 1995 (Vic). In addition Federal industrial laws even seek to achieve anti-

¹ Hunter (2006 p. 91) defines two types of discrimination: “direct discrimination occurs when a woman is treated less favourably by her employer, because of her sex, marital status, pregnancy, parental status or family responsibilities, than the employer treats or would treat a male co-worker, or one who is not married, not pregnant, or without children or other family responsibilities. Indirect discrimination occurs when an employer imposes a particular requirement or condition of employment that has an adverse impact on women or on workers with family responsibilities.”

discriminatory objectives (e. g. Workplace Relations Act 1996 (Cth)). For example, maternity leave provisions are included in this act. Australia has also had a Federal Equal Opportunity for Women in the Workplace Agency since 1986. The Act requires companies with 100 or more employees to establish a workplace program to remove the barriers to women entering and advancing in the workplace and to report regularly to Government. However, at the time of writing the requirement is to have policies in place but there is no external mechanism to ensure that the policies are actually achieving benefits for women in the workplace. The sanctions for non-compliance are that the company will be named in parliament and the company will be ineligible to tender for Government contracts and industry assistance. Unfortunately, most Australian employers see equal opportunity for women as a risk management issue that reduces legal exposure. Equal opportunity needs to be seen as a strategic business initiative that will increase profits (Why EO Makes Good Business Sense 2010).

3.1 THE NATURE OF THE DATA

This study uses the latest releases of data from the Australian Bureau of Statistics (ABS). There were three data sources used: the 2006 Australian Census data (ABS 2006), the ABS Labour Force survey data (ABS 2010) and the Employee Earnings and Hours (EEH) survey data ABS 2008). Each data source is discussed in turn below.

3.1 The 2006 Census Data

In September 2006, the Australian and New Zealand Standard Classification of Occupations (ANZSCO) was introduced (ABS 2006). This standard is used by the Australian Bureau of Statistics (ABS) and is used by other Australian government agencies when classifying employment information. Briefly, ANZSCO uses a 6-level coding system that classifies an occupation according to criteria such as; the common and alternative job titles, the skill level of the job and the common tasks carried out. The 2006 census data set used in this study is at the four digit code level and provides over 350 unit occupation groups of which eight are relevant to the ICT occupations considered in this study and where significant skill levels are required. ANZSCO identifies a greater number of ICT unit groups and occupations compared with the Australian Standard Classification of Occupations Second Edition (ASCO2) codes used in the 1996 and 2001 censuses. The ANZSCO unit occupation groups are at a similar level of detail to the six digit ASCO codes used in the 1996 and 2001 censuses. However, new occupation titles and new occupations are available in the ANZSCO code set making direct comparisons across the three censuses problematic. The ANZSCO scheme affords a much more detailed description of ICT occupations however it does not allow for direct comparisons with the ASCO2 scheme. Fortunately data coded using both schemes are available to the unit group level for the 2006 census which allows data on ICT managers and ICT computing professionals from the last three censuses to be compared.

3.1.1 Occupation Descriptions

The occupation descriptions shown below are those provided by the ABS (2006). The associated ANZSCO four digit codes are displayed for the minor occupation groups examined in this study. The first digit of these codes indicates the broad occupation group to which these unit groups belong and skill level required decreases as this number increases. A first digit of 1 indicates the broad group Managers and a 2 indicates the broad group Professionals. The second third and fourth digits indicate increasing degrees of specialisation.

- **1351, ICT Managers** plan, organise, direct, control and coordinate the acquisition, development, maintenance and use of computer and telecommunication systems within organisations.
- **2611, ICT Business and Systems Analysts** work with users to formulate system requirements, develop system plans and documentation, review and evaluate existing systems, and design and modify systems to meet users' business needs.
- **2612, Multimedia Specialists and Web Developers** create computer animation, audio, video and graphic image files for multimedia presentations, games, motion pictures, CD-ROMs, information kiosks and the web, and plan, produce and maintain web sites and web applications using web programming, scripting, authoring, content management and file transfer software.

- **2613, Software and Applications Programmers** design, develop, test, maintain and document program code in accordance with user requirements, and system and technical specifications.
- **2621, Database and Systems Administrators, and ICT Security Specialists** plan, develop, maintain, manage and administer organisations' database management systems, operating systems and security policies and procedures to ensure optimal database and system integrity, security, backup, reliability and performance.
- **2631, Computer Network Professionals** research, analyse and recommend strategies for network architecture and development, implement, manage, maintain and configure network hardware and software, and monitor and optimise performance, and troubleshoot and provide user support.
- **2632, ICT Support and Test Engineers** develop procedures and strategies to support, create, maintain and manage technical quality assurance processes and guidelines and systems infrastructure, investigate, analyse and resolve system problems and performance issues, and test the behaviour, functionality and integrity of systems.
- **2633, Telecommunications Engineering Professionals** design, construct, install, service and support telecommunications equipment, systems and facilities.

The occupation groups chosen for this study all have a minimum entry requirement of a bachelor degree or experience considered equivalent. Note also that the data used in this study does not include ICT research and teaching professionals within the education sector. Where education is mentioned as an industry sector it only includes the IT occupations that would be associated with a computer support centre.

3.2 The Labour Force Survey Data

In contrast to the census data the labour force survey data is sample data and represents approximately 0.33% of the civilian population of Australia aged 15 years and over (ABS 2010). The labour force survey provides detailed descriptions on a limited number of variables on a quarterly basis, whereas the census provides detailed descriptions of a much larger set of variables once every five years. The ABS ensures that the labour force survey data is comparable over time with respect to occupational categories and other grouping variables. This is not necessarily always the case with census data.

3.3 The Employee Earnings and Hours Survey Data

This data provides hourly full time and total earning rates for men and women disaggregated to the three digit ANZSCO level. For example, when considering income, accurate estimates of hourly wage rates are available from the EEH data but only to three digit occupation level. In contrast the census data can be disaggregated to four digit levels but only provides grouped income data which affects the accuracy of some income point estimates.

4. DATA ANALYSIS AND DISCUSSION

Figure 1 shows the quarterly trend estimates for ICT managers and professionals in Australia during the period July 1996 to April 2010. There has been an overall upward trend in employment in these occupations with most of the growth being in the ICT professional group. Although there are several periods where numbers decreased and then quickly recovered, the period from mid 2002 to mid 2005 was a period of sustained decline and appears to be followed by two year cycles that have steadily decreased in amplitude. The upward trend in numbers continues and if Australia really has avoided the worst effects of the global financial crisis, we should see this persist into the future.

Figure 2 shows the variation in women's participation in the ICT management and professional occupations for the period July 1996 to April 2010. For ICT professionals the proportion of women has certainly not increased in this period and if anything has declined slightly. For managers the situation has been much more variable, but there does appear to be a slight upward trend overall. The

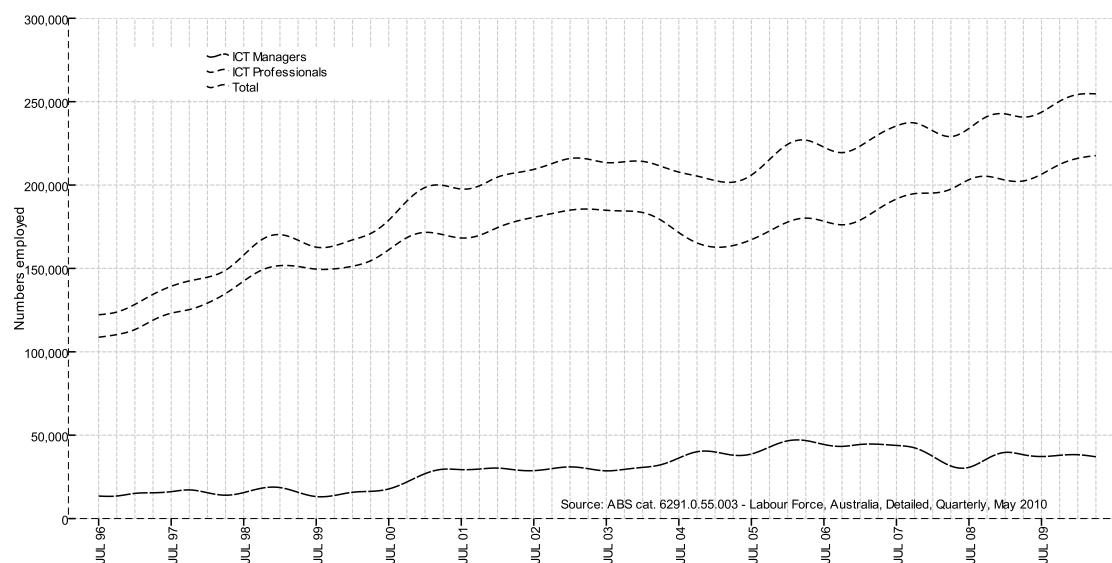


Figure 10 Growth in ICT managers and professionals July 1996 to April 2010

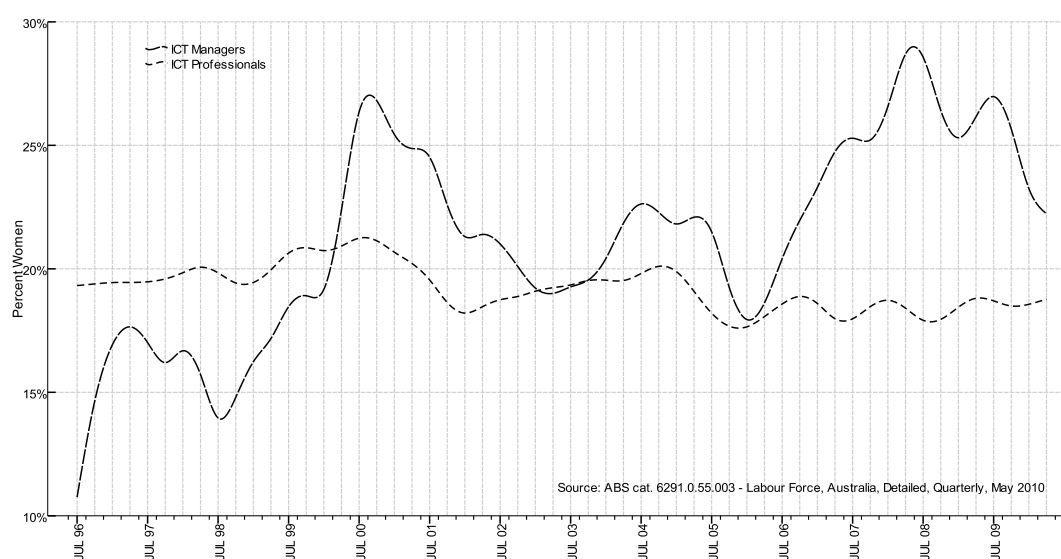


Figure 20 Women's participation in ICT manager and professional occupations July 1996 to April 2010

high variability in the numbers of women managers is partly explained by sampling variation and the relatively small numbers involved.

Figure 3 is based on 2006 census data (ABS 2006) and displays the participation rate of women employed in ICT occupations across major industry sectors compared to the overall participation rate of women in these sectors. The minority position of women in the ICT workforce is a common theme

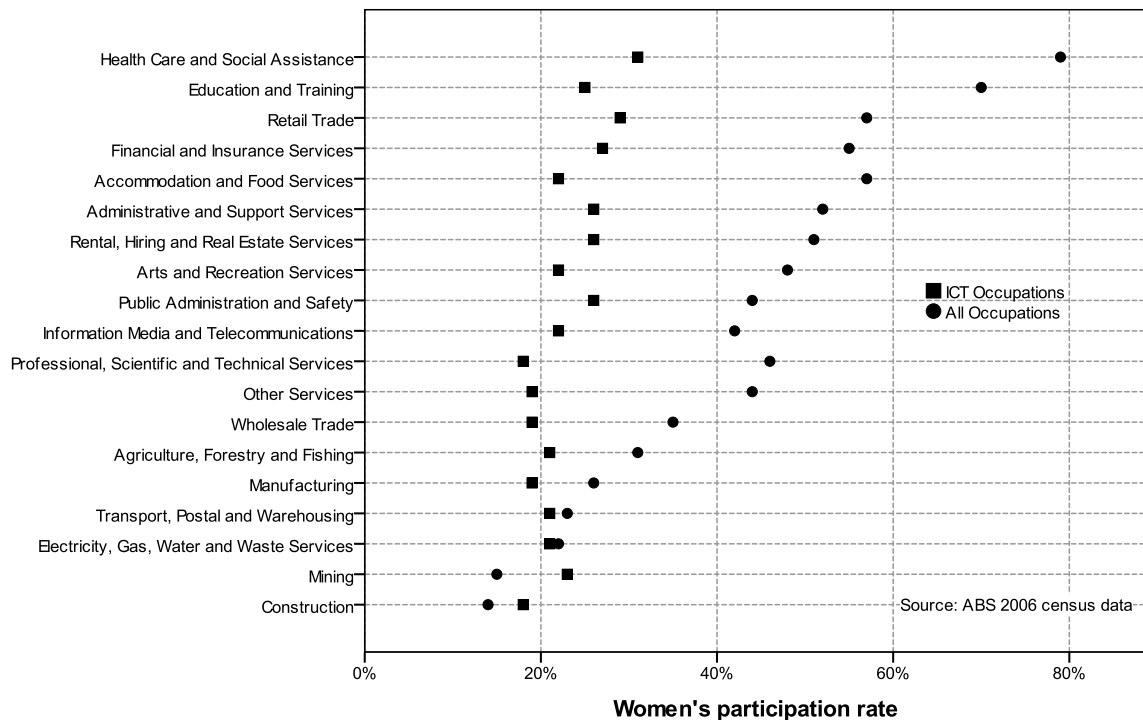


Figure 30: Women's participation in ICT occupations compared with all occupations within each major industry sector

in all industry sectors. Even those sectors traditionally dominated by women such education, health and retail trade exhibit participation rates of 30 percent or less.

Table 1 shows data on ICT managers and ICT professionals for the 1996, 2001 and 2006 censuses. Between 1996 and 2001 there was substantial growth in these occupations with the total numbers climbing from 96,192 to 153,691 representing a 60 percent increase. This rapid growth was followed by virtual stagnation over the next 5 years with the 2006 total of 159,021 representing an increase of just 3.5 percent on the 2001 figure. In the same period the Australian workforce increased by 8.3 percent. The below average growth in ICT employment over the 2001-2006 period is no doubt related to the aftermath of the dotcom crash of 2000.

Year	ASCO2 Group	Male	Female	Total	WPR
1996	Computing Professionals	63423	17961	81384	22.1%
	IT Managers	11666	3142	14808	21.1%
	Total	75089	21103	96192	21.9%
2001	Computing Professionals	102950	23543	126493	18.6%
	IT Managers	21101	6097	27198	22.4%
	Total	124051	29640	153691	19.3%
2006	Computing Professionals	102197	25227	127424	19.8%
	IT Managers	24997	6600	31597	20.1%
	Total	127194	31827	159021	20.0%

Table 10: Size of ICT Managers and Professionals workforce by gender 1996, 2001, and 2006

Table 1 also shows women's participation rates (WPR) in ICT professional and management roles have not changed significantly in the ten years to 2006 and in fact may have deteriorated. Therefore

the many efforts to encourage and retain women in ICT education (e.g. Craig et al. 2009; Martin et al. 2006) appear to have had little or no effect. Although the ICT workforce grew by more than 60,000 in the ten year period 1996 to 2006, women's participation has remained low compared to their participation in the general workforce which increased from 44 percent in 1996 to 46 percent in 2006.

The scarcity of women in the ICT workforce is not a new phenomenon and has been attributed to, among other things, an inability to attract women into ICT education, inadequate gender inclusion strategies, the poor work-life balance offered by the sector, lack of care supportive policies, assigning women to stereotypical roles such as designing children's websites, a lack of role models, outright discrimination and the image of the ICT industry as a male dominated sector that is not "women friendly" (McKeogh & Preston 2006).

Direct evidence of large scale discrimination against women in the ICT workforce is difficult to find however indirect measures such as income and the proportion of women in management roles do provide indicators of possible gender bias. The proportion of all women employed in ICT occupations who are managers is 11.9% and for men the figure is 12.2% so there does not appear to be any bias preventing women entering high status occupations in the ICT workforce. On the income side however there does appear to be a disparity with significantly lower percentages of female managers and professionals achieving the highest income brackets. Figure 4 is based on ABS 2006 census data and displays the weekly gross income distributions for men and women employed full time as ICT managers and ICT professionals. It is clear from the figure that a smaller proportion of women in these occupations manage to make it to the highest income groups. For example, approximately 13 % of female ICT professionals earn \$2000 or more per week, while about 20% of male ICT professionals earn above this amount. This gap is even more pronounced for ICT managers where 35% of females earn \$2000 or more per week, while 47% of males earn in this range. More detailed analysis of the ICT professionals shows that the pay disparities observed in aggregate are also present at the unit group level.

One possible explanation of the disparities revealed in Figure 4 is that women are concentrated (by choice or design) in "low value" managerial and professional roles. The available data do not allow for the level of disaggregation required to examine this hypothesis so it must remain mere speculation at this stage.

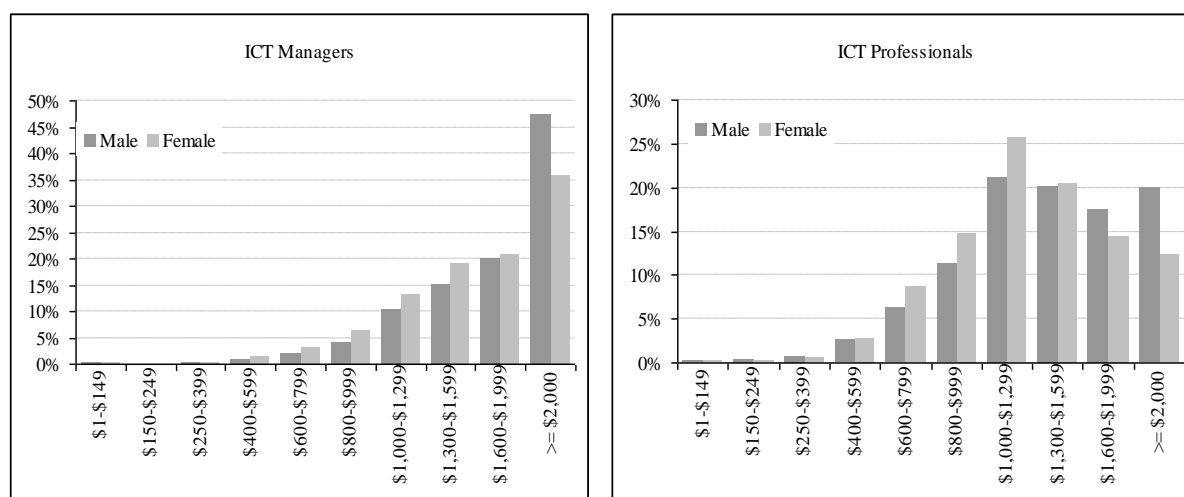


Figure 40 Income distributions for males and females employed full-time as ICT managers and ICT professionals

4.1 The Gender Pay Gap

In this work the gender pay gap is defined as one minus the ratio of average full-time earnings of women to average full-time earnings men. Figure 5 shows that the gender pay gap for the total

Australian workforce trended down to approximately 15% in mid 2004 followed by a small upward movement over the next three and a half years to about 15.5%. This was followed by a sharp rise over the next two years to a value of 18% in February 2010. The reasons for this sudden increase are unclear but note that it follows a period of major changes in the Australian workplace (i.e. WorkChoices²) and the global financial crisis.

Although it is very rare to find examples of overt discrimination in remuneration, indirect discrimination does occur due to rules and practices that appear to treat men and women equally, but which in practice work to the disadvantage of women (Jost 1998). The Federal Workplace Relations Act (1996) and the Federal Sex Discrimination Act (1984) both contain strong provisions requiring employers to accord men and women equal pay for work of equal value. Claims for equal pay can be made to the Australian Industrial Relations Commission under the first act and to the Human Rights and Equal Opportunity Commission under the second and herein lies part of the problem. That is, the enforcement process places the burden of action on the women being discriminated against which has worked against the cause of equity (Charlesworth 2007). In a study of the IT industry, Hunter (2006) points to specific characteristics that discourage discrimination complaints by women. She says the IT industry's "strongly individualist ethos, the weakness and limited reach of union organization and industrial regulation, and its relatively small size" (Hunter 2006 p.105) are contributors to this situation.

There are many factors underlying the overall gender pay gap and not all of them are overtly discriminatory. A recent detailed analysis and report prepared for The Diversity Council of Australia (KPMG 2009) identified the key factors contributing to the gender pay gap in the Australian workforce. These factors along with their estimated relative contributions to the gender pay gap and interpretations are shown in Table 2. Note that the list does not include education level which, although it does affect remuneration levels, does not play a role in the gender pay gap in Australia although studies in Europe have found it to be a significant factor (Olsen & Walby 2004).

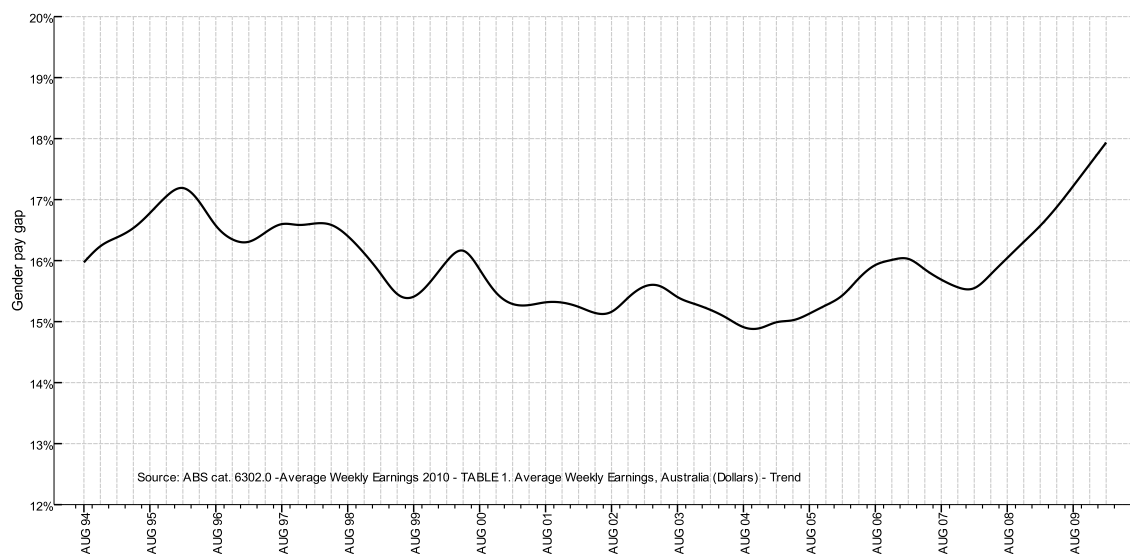


Figure 50 The gender pay gap for the Australian workforce 1994 to 2010

² Workplace Relations Act 1996, as amended by the Workplace Relations Amendment Act 2005

Factor	Contribution to gender pay gap	Rationale
Experience	8%	Remuneration increases with increasing experience. The effect is not linear and tends to decrease over time and eventually reaches a limit. Age is used as a proxy for this factor.
Tenure with current employer	3%	Remuneration increases with increasing tenure. The factor is correlated with the experience factor but measures experience with a single employer.
Years not working (interruptions)	9%	Remuneration may be negatively affected by career interruptions due to caring responsibilities or a variety of other reasons. It could be argued that this is really another form of sex discrimination.
Industry segregation	10%	Industries with high proportions of women or men are likely to exhibit lower or higher remuneration for occupations that are otherwise identical in non-segregated industry sectors. For example, female ICT managers in the Health sector being paid less than they would receive in the Financial and Insurance sector.
Occupational segregation	18%	Occupations dominated by women or men are likely to exhibit lower or higher remuneration than non-segregated occupations requiring similar skills and effort (e.g. nurses and ambulance drivers).
Share in part-time employment	14%	Those working part-time generally earn less than those working full time in similar occupations.
Share working in government or NGOs	3%	The gender pay gap varies between the private sector and the combined government and non-government organisations (NGOs) sector.
Sex discrimination and unobserved heterogeneity between men and women	35%	This factor has two components that cannot be separated unless the sample contains matched pairs of men and women which was not possible with the data used in the report.

*Table 20*****Key factors influencing the gender pay gap (KPMG 2009).*

A number of other hypothesised factors are absent from this list (Shields 2010). For example, there has been a move since the 1990s from job based pay systems to a systems based on the individual's skills and abilities. This opens the door for women's skills and abilities to be undervalued and for competencies to be designed that are skewed towards traits more often found in men. Another factor is the increase in individual and group performance pay schemes where there is some evidence that women are more conservative in setting goals. And a final factor is the confidentiality clauses that came with Australian workplace agreements (AWAs³) and WorkChoices which disadvantage women by not allowing pay transparency.

Accurate estimates of the gender pay gap are available at the ANZSCO three digit occupation level from the EEH survey (ABS 2008) and are shown for professional occupations in Figure 6. The gender pay gaps for the three three-digit ICT professional occupations (red squares) are shown within the context of all other three-digit professional occupations (black circles).

³ AWAs are formalized agreements of employment conditions negotiated between an individual and an employer without the involvement of a trade union.

Interestingly, there is a very small gender pay gap for 'Tertiary education teachers'. This is most likely due to the sector being largely Government run and having enterprise bargaining in place (Arulampalam et al. 2007). Of the three ICT occupations, 'Business and systems analyst, programmers', exhibits the smallest gap at 9.3% followed by 'Network and support professionals' at 13.5% with 'Database and systems administrators and ICT security specialists' having the largest gap at 21.2%. While the first two occupations have gender pay gaps below the national average of approximately 16% in 2008, the gap for the third group is well above this and ranks fourth worst in terms of gender pay equity.

Since the gender pay gap was calculated for full-time earnings and has been disaggregated to specific occupation groups, two of the major factors occupational segregation and share in part time employment are largely controlled for and therefore contribute little to the pay gaps displayed in Figure 6. The remaining factors therefore contribute a total of 68% to the gender pay gap of which sex discrimination and unobserved heterogeneity contributes 35% (see Table 2). Thus at least half of the observed gender pay gaps displayed in Figure 6 can be attributed to direct sex discrimination and unobserved heterogeneity between men and women. Unobserved heterogeneity refers to traits such as individual motivation and other non-gender related attributes that may influence a person's earnings (Polachek & Xiang 2009). Evidence from Gangji et al. (2010) indicates that unobserved heterogeneity contributes between 7 and 40 percent of the effect of this component. Therefore a very conservative estimate of the gender pay gap due to direct sex discrimination alone is around one quarter of the value observed in Figure 6. For the three ICT occupations the estimated gender pay gaps due to direct sex discrimination are

- 261 Business and systems analysts, and programmers $0.25 \times 9.3\% = 2.3\%$,
- 262 Database and systems administrators, and ICT security specialists $0.25 \times 21.2\% = 5.3\%$,
- 263 ICT network and support professionals $0.25 \times 13.5\% = 3.4\%$.

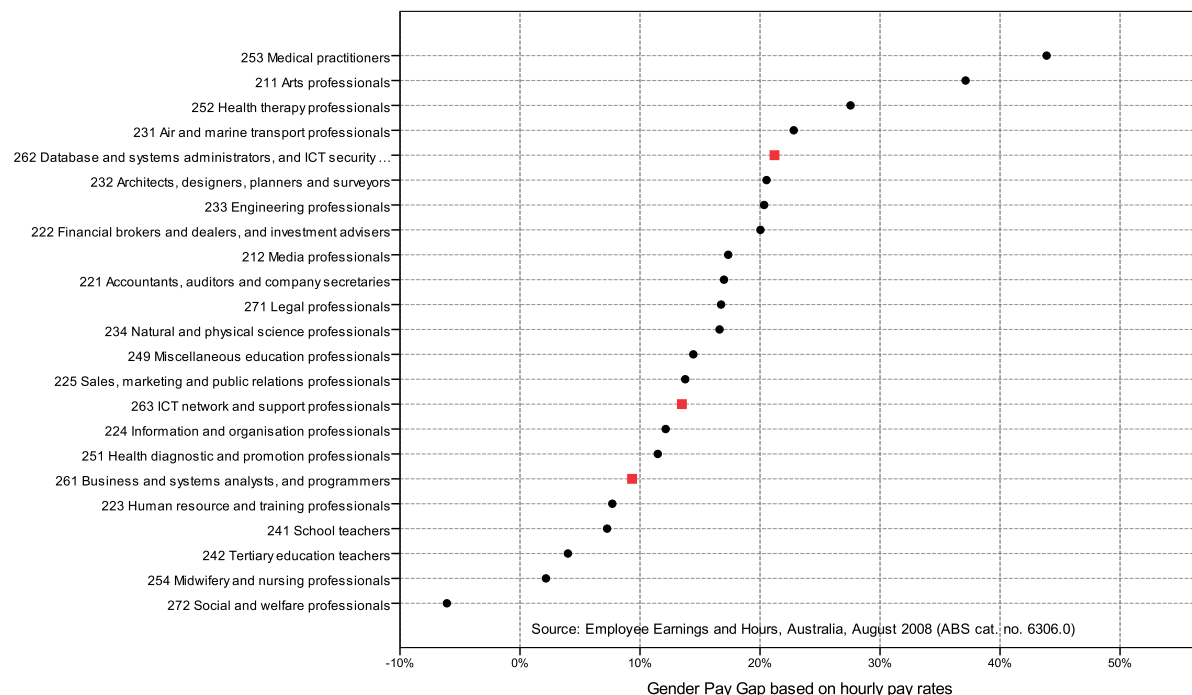


Figure 60: Gender pay gap for all professional occupations at the ANZSCO three digit level (squares indicate ICT occupations)

Of course these figures ignore factors such as tenure, years not working and industry segregation which are forms of indirect discrimination.

Kee (2006) found that where a gender pay gap exists, it tends to be more pronounced in the upper income brackets and this appears to be the case in ICT occupations. The income distributions for the three ICT professional groups are displayed in Figure 7 where in all cases the percentage of women in low income groups is higher than men, whereas the percentage of men in the upper income groups is higher than women. These differences are particularly pronounced for the Database and systems administrators and ICT security specialists, which is consistent with the very high gender pay gap for this occupation discussed above.

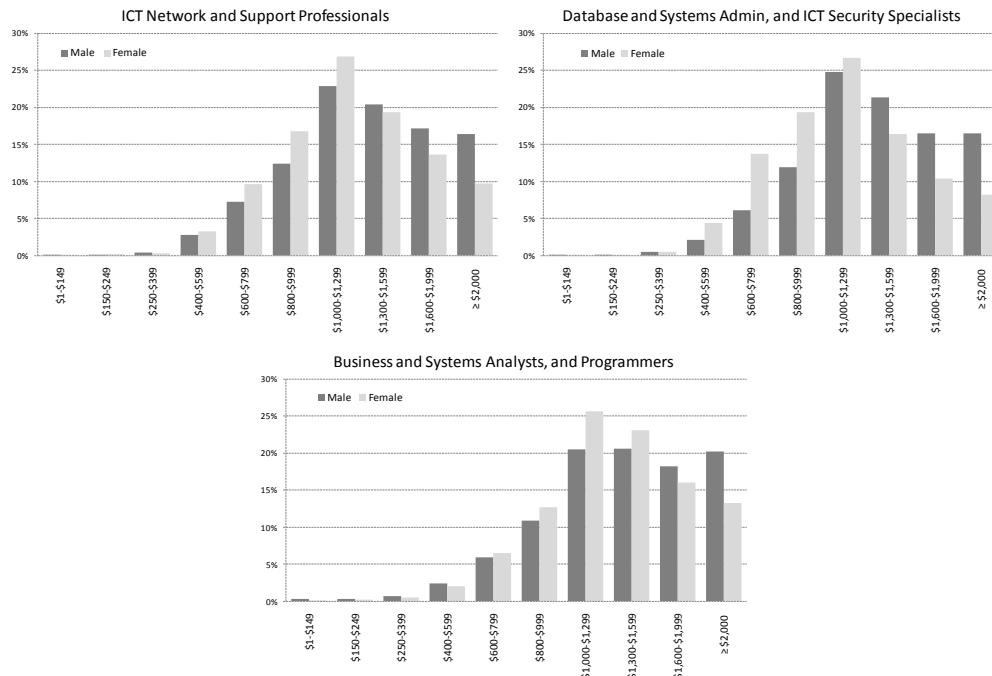


Figure 70 Income distributions of men and women for three ICT professional occupations (ANZSCO three digit level)

Thus, using Hunter's (2006 p. 91) definitions, direct sex discrimination accounts for a relatively small (2 to 5 percent) but significant part of the overall gender pay gap. It also appears that direct discrimination is more pronounced in upper income levels indicating that females in senior positions are considerably less valued by organisations than men in similar roles. This type of discrimination is relatively easy to identify and could be addressed through improved policies, their proper implementation and increased awareness of the problem among women. In terms of its impact on individuals, indirect discrimination is no less important and makes a much larger contribution to the gap. This type of discrimination is much more difficult to identify than the direct form as it may go unnoticed by women within a particular industry or occupation due to the lack of men in comparable roles. Identification and addressing indirect discrimination may require the combined efforts of government, industrial organisations and individual companies. This is a most unlikely outcome in the current Australian industrial climate which has moved away from a global approach to setting wages and conditions for workers. Also, many organisations actively discourage internal salary comparisons by placing non-disclosure clauses in employment contracts which can only be intended to obscure wage disparities within occupations. This lack of transparency along with impotent government regulations are surely major contributors to the gender pay gaps identified in this paper.

5 CONCLUSION

Women's participation rate in the ICT industry from 1996 through to 2006 has remained stubbornly fixed at around 20%. This may be due to a lack of suitably qualified women which in turn has been attributed to the general image problem of ICT careers in recent times (ICT Skills Research 2007). This lack of diversity in the IT workforce is a subtle discrimination and unethical (Johnson & Miller, 2002). There are many non-essential job characteristics of the IT industry that make it unfair and discouraging for women to enter the field, such as few women working in the field, long hours and

the difficulty of maintaining a work-life balance (Whitehouse 2006). With few women working in the IT industry it becomes a self-perpetuating situation because women do not want to work in an industry where there are few women (Camp, 1997). This combined with the evidence provided in this paper of a gender pay gap can only serve to further discourage women unless this and the culture within the ICT workplace are addressed. Despite government legislation (Equal Opportunity for Women in the Workplace Act 1999 (Cwlth)) and the well developed workplace policies implemented by many large organisations to combat discrimination, it still appears to exist. The social and economic benefits that would flow from more women employees should be in the minds of senior ICT managers when implementing structures and policies in their workplaces.

This paper is intended to identify the nature and extent of the gender pay gap in the IT industry however simply reporting on the situation does nothing to change it. Although direct gender discrimination does play a minor role, it is the indirect forms of discrimination that have the largest impact on gender pay equity. Further work is required to refine the definitions of these components and raise awareness of their existence and impacts within the IT industry. With more detailed data it should, in theory at least, be possible to remove the effects of confounding factors such as education level and individual motivation which would counter claims that pay differentials are due to causes other than gender discrimination. A well designed survey is one way in which such data may be acquired.

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